State of South Dakota

2021 Forest Health Highlights

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General Overview:

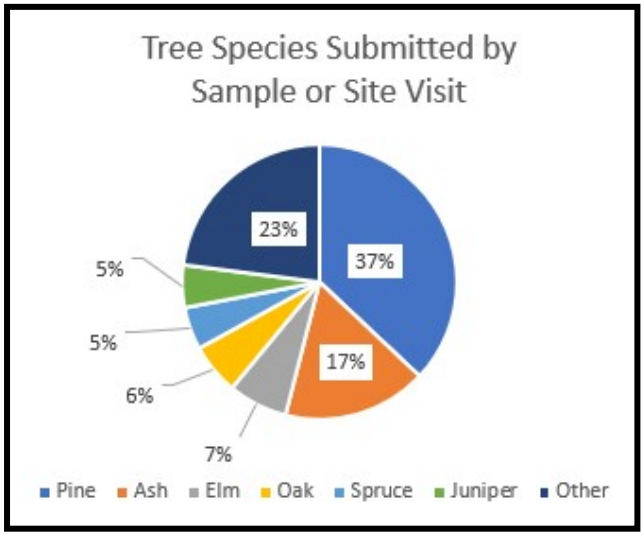
The most common tree genus from which samples were submitted or inspected during site visits was pine, *Pinus* (37%). About a third of these were for ponderosa pine (*P. ponderosa*) with most of the site visits occurring in the Black Hills. The common stressor was the pine engraver beetle. Two years of drought left the native pines in the Black Hills susceptible to successful attack. There were also infestations of the six-spined engraver beetles in the Southern Black Hills. About half the pine site visits were related to Scotch (*P. sylvestris*) and Austrian (*P. nigra*) pines, most of these trees were declining from pine wilt disease which is now found throughout the state.

The second most common genus was ash, *Fraxinus* (17%). Almost all the ash were green ash (*F. pennsylvanica*), one of the most common trees in South Dakota community forests and windbreaks. Most of these trees were infested with the native boring insects. There were also flower hermit beetles, ash plant bugs, and ash leaf curl aphids. There were also outbreaks of lecanium and oystershell scales on ash in some communities. Ash flower galls and seed weevils were submitted as e-samples or identified during site visits. We continue to find ash infected with verticillium wilt; these symptoms are frequently mistaken for those presented by EAB.

The third most common genus was elm, *Ulmus* (7%). Most of the samples and site visits were regarding defoliation by the European elm flea weevil. The most infested trees were Siberian elms (*U. pumila*) and hybrid elms such as Vanguard elm (*U.* 'Morton Plainsman') which have Siberian elm in their lineage. American elms were identified with lecanium scale and Dutch elm disease (DED).

There were two genera that each accounted for 6% of the samples and site visits, oak (*Quercus*) and spruce (*Picea*). Juniper (*Juniperus*) made up 5% of the samples and site visits. The remaining samples and site visits were of numerous genera including maples (*Acer*), elms, catalpa (*Catalpa*), hackberry (*Celtis*), honeylocust (*Gleditsia*), crabapple (*Malus*) and walnut (*Juglans*) among others.

Drought was the most common abiotic stress agent in the state during 2021. There were many trees that exhibited scorched and wilting leaves by the end of the summer. Almost the entire state, except for the northeastern corner was under severe or extreme drought conditions for much of the year. Most of the state received above-average precipitation during the fall. Currently most of the state is considered abnormally dry or under moderate drought .



Pie graph showing the percentage of tree species submitted by species during FY2021

Confirmed Insects & Mites

By samples submitted or pictures sent via phone or email

- Apple maggot *Rhagoletis pomonella*
- Ash/lilac borer *Podosesia syringae*
- Ash bark beetle *Hylesinus*
- Ash bead gall mite *Aceria fraxini*
- Ash bullet gall midge *Dasineura pellex*
- Ash plant bug *Tropidosteptes amoenus*
- Ash seed weevils *Lignyodes bischoffi*
- Ash-grey blister beetle *Epicauta fabricii*
- Banded elm bark beetle *Scolytus chevyrewi*
- Banded ash borer *Neoclytus caprea*
- Basswood leaf miner *Baliosus nervosus*
- Boxelder bug *Boisea trivittata*
- Bronze birch borer *Agrilus anxius*
- Carpenterworm *Prionoxystus robiniae*
- Cedar bark beetle *Phloeosinus*
- Codling moth *Cydia pomonella*
- Cotoneaster leaf crumpler *Acrobasis indigenella*
- Cottonwood borer *Plectrodera scalator*
- Cottonwood leaf beetle *Chrysomela scripta*
- Dogwood sawfly *Macremphytus tarsatus*
- Eastern tent caterpillar *Malacosoma americanum* , the western tent caterpillar *M. californicum* and the forest tent caterpillar *M. disstria*
- Elm leaf beetle *Xanthogaleruca luteola*
- Emerald ash borer *Agrilus planipennis*
- European elm flea weevil *Orchestes steppensis* syn. *alni*
- Fall webworm *Hyphantria cunea*
- Fall cankerworm *Alsophila pometaria*
- Flower hermit beetle *Osmoderma eremicola*
- Fruittree leaf roller *Archips argyospila*
- Gall wasp *Callirhytis flavipes*
- Hackberry nipple gall maker *Pachypsylla celtidismamma*
- Honeylocust pod midge *Dasineura gleditschiae*
- Japanese beetle *Popillia japonica*
- Lecanium scales *Parthenolecanium*
- *Lymantri dispar* 14 caught in traps during 2021
- Maple bladder gall mite *Vasates quadripedes*
- Metallic woodborer *Buprestis confluenta*
- Pear slug *Caliroa cerasi*
- Pigeon tremex *Tremex columba*
- Pine engraver beetle *Ips pini*
- Poplar borer *Sapera calcarata*
- Poplar vagabond aphid *Mordvilkoja vagabunda*
- Six-spined engraver beetle *Ips calligraphus*
- Spruce bud scale *Physokermes piceae*
- Spruce needleminer *Endothenia albolineana*
- Turpentine beetle *Dendroctonus valens*
- Twolined chestnut borer *Agrilus bilneatus*
- Velvet erineum gall mite *Aceria aceris*
- Willow sawfly *Nematus ventralis*
- Zimmerman pine moth *Dioryctria*

Flower hermit larva
(SD DANR, RC&F)

Confirmed Diseases

By samples submitted or pictures sent via phone or email

- Apple scab *Venturia inaequalis*
- Ash anthracnose *Plagiostoma fraxini*
- Ash rust *Puccinia sparganioides*
- Bacterial blight of lilac *Pseudomonas syringae* pv. *syringae*
- Black knot *Apiosporina morbosa*
- Botryosphaeria canker *Botryosphaeria stevensii*
- Cedar-apple rust *Gymnosporangium juniperivirginianae* , cedar-hawthorn rust *G. globosum* , and cedar-quince rust *G. clavipes*
- Cercospora blight *Pseudocercospora juniperi*
- Cereal rust fungus *Puccinia coronata*
- Diplodia tip blight *Diplodia pinea*
- Dothistroma needle blight *Dothistroma pini*
- Dutch elm disease *Ophiostoma novo-ulmi*
- Fireblight *Erwinia amylovora*
- Kabatina twig blight *Kabatina juniperi*
- Lilac leaf spot *Pseudocercospora*
- Marssonina blight *Marssonina brunnea*
- Phomopsis twig blight *Phomopsis juniperovora*
- Plum pockets *Taphrina communis*
- Tar spot *Rhytisma acerinum*
- Spruce needlecast *Stigmina lautii and Rhizosphaera kalkhoffii*
- Valsa cytospora canker *Valsa kunzei*
- Walnut anthracnose *Ophignomonia leptostyla*
- Willow scab *Venturia saliciperda*
- Verticillium wilt *Verticillium dahliae*

Diplodia tip blight

(SD DANR, RCF)

Sample Photos Submitted

with Follow-Up Site Visits

- Chlorosis (*Acer rubrum*, *A.* x *freemanii*, and *Betula nigra*)
- Drought (*Acer and Picea)*
- Fall needle drop (*Pinus, Picea*)
- Winter- burn (*Abies*, *Taxus* and *Thuja*)

Wilting caused by drought stress

(SD DANR, RCF)

Woody Plant Identification

- Chokeberry *Aronia melanocarpa*
- Common buckthorn *Rhamnus cathartica*
- Hedge cotoneaster *Cotoneaster lucida*
- Tatarian honeysuckle *Lonicera tatarica*
- White mulberry *Morus alba*

Highlighted Insect Conditions: Emerald Ash Borer

Ash trees infested with emerald ash borer (EAB) can be found throughout Sioux Falls, though the highest density of infested trees are in the northern half of the city. Infested trees are often in groups of only a few to more than twenty. Infested trees are identified by common symptoms of an infestation – woodpecker blonding, a portion of the canopy with smaller, lighter green foliage, sprouting growth, and cracks along branches. Since an infested tree may not present any symptoms until two years after the initial attack, there are likely far more infested trees than the ones we have detected.

We are about a year away from a significant increase in tree mortality in Sioux Falls. Fortunately, the City of Sioux Falls is being very proactive and has been removing ash trees from parks and boulevards in anticipation of the spread of mortality throughout the community. This will be a great help in avoiding a steep death curve when the sheer number of dead and dying ash overwhelms community resources in dealing with them.

The infestation in Canton is progressing faster as the number of ashes, about 600, is far less than the more than 80,000 in Sioux Falls. While the Canton infestation was first detected in 2020, infested trees presenting with extensive dieback are now common along the western half of this small community. An infested tree was found in Worthing in 2020 but the infestation is moving slower and only a small number of trees are presenting severe symptoms.

There has been little interest among the public in treating ash trees in Canton and Worthing. Sioux Falls has about 15,000 ash trees currently being treated. Tree companies have reported that renewal rates are about 70 to 80% for the second application. Many of these trees were first treated in 2018 with the second treatment applied in 2020.

Community tree inventories

Street and park tree inventories are still being conducted for interested communities. There are two types of inventories available. One is a driving survey to identify all the ash in a community and classify the trees into three classes based on height – less than 15 feet tall, 15 to 30 feet tall and more than 30 feet tall. No location data is collected. This simple survey helps a community determine how to plan for removals and replacements prior to emerald ash borer being confirmed in their community.

The second survey is more detailed and all trees in a community are identified by locations (GPS), species, dbh, height, and condition. The data is collected using the TreePlottter software system. It takes about three to four minutes to enter the data and move on to the next street tree.

The most recent community inventory completed this way was Dakota Dunes. It has 1,692 street and park trees in a 1.5 square mile community of 2,800 people. About 36% of their street and park trees are ash, a common percentage for many eastern South Dakota communities.

Herd Immunity study

We are conducting a 100% inventory of the ash trees in Sioux Falls as part of herd immunity study. We have the location of every commercially treated ash tree in the community and are locating all the other ash. This data will be used to set plots to determine whether treating ash trees provides any protection to the surrounding untreated ash. The density of treated trees within the ash population as well as the distance from the treated tree or trees is also being investigated.

Emerald ash borer development

Sampling for emerald ash borer was conducted from early April to early November 2021.

GDD	Calendar	Dominant EAB stages	Phenological event
110	Early April	J-shape larva	Corneliancherry in bloom
180	Late April	Prepupa	Apple serviceberry in bloom
270	Early May	Prepupa, pupa	
400	Late May	Pupa	Vanhoutte spirea in bloom
550	Early June	Adults emerge, pupa	Black locust in bloom
1000	Late June	Emergence peaks	Littleleaf linden in bloom
1300	Early July	Emergence declines	Falsespirea in bloom
1700	Late July	1st and 2nd instar lava	
2100	Early August	1st and 2nd instar larva	
2500	Late August	2nd and 3rd instar larva	
2700	Early Sept	3rd instar larva	
3000	Late Sept	3rd and 4th instar larva	
3300	Early Oct	4th instar larva	
3500	Late Oct	4th and J-shaped larva	
3550	Early Nov	J-shaped larva	

Development of EAB based on Growing Degree Days (GDD)

(Dr. John Ball, RCF)

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Herbicide Study—Dicambia Drift Exposure

Foliage sampling of 248 trees presenting symptoms commonly associated with herbicide drift were collect from 2018 through 2020. The data collected on each sampled tree included GPS co-ordinates, species, injury pattern, symptom description, pattern of damage on adjacent trees and vegetation, and the presence of other possible damage agents.

The most common tree species submitted for herbicide analysis were hackberry, followed by bur oak and redbud. Other species submitted include bald-cypress, black walnut, boxelder, Chinese chestnut, Colorado spruce, eastern pin oak, Kentucky coffeetree, mulberry, northern red oak, silver (Freeman) maple, and willow oak. The most common symptoms described on the submission form was cupping and curling. Abnormal elongation and inter-veinal chlorosis were also mentioned in the forms for many of the samples. About half the samples identified that more than 50% of the tree's canopy was affected with another fourth of the sample forms stating 26% to 50% of the canopy was presenting symptoms. These symptoms are like those presented from 2,4-D drift exposure so it can be difficult to separate the two. However, dicamba exposure does not result in a twisted or curled petiole. Since 2,4-D and dicamba appeared in almost all the samples, separating the two may not be needed.

Annual Insect and Disease Training

The Division of Resource Conservation and Forestry's strategic plan requires one insect and disease training be held each year for division personnel to improve diagnoses of common problems of trees in South Dakota. These training are also open to other agencies and individuals looking to expand their knowledge of tree insects and diseases. The 2021 training was held in Sioux Falls, SD on July 14 & 15. The training included identification of common South Dakota trees and pests, a tree identification and pest quiz, and an EAB field trip to Canton, South Dakota.

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